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An Empirical Analysis of the Main Determinants and the Relative Contributions of Changes in Bank Capital Base to the Efficiency of Nigerian Commercial Banks

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Abstract
The paper examined and analyzed the main determinants and the changes in capital base to the efficiency of Nigerian Commercial Banks. The study utilized secondary data covering 16 years on the commercial banks in existence between 1992 and 2007. Data on key performance indicator of the banks such as total income, interest rates, total credits, and branch networks were sourced from the "fact books" published by the Nigerian Stock Exchange (NSE) and official publications of the selected banks. Econometrics techniques were used to appraise the main determinants and the relative contributions of changes in capital base to the efficiency of Nigerian Commercial Banks over the studied period. The results showed that capital base requirement was ineffective in reducing distress in the banking industry. More important, bank capital was a major determinant of bank performance and efficiency. Also, the capital base requirement by the Central Bank of Nigeria lagged behind the average capital base of the banks. The study concluded that the Central Bank of Nigeria could use the regulatory power of raising the capital base of banks to stimulate greater profitability and efficiency in the banking sector.
Keywords: Efficiency, Bank Performance, Banking Reforms, Capital Adequacy, Commercial Banks, Nigeria.

INTRODUCTION

Banks play an invaluable role in the economy. It is quite known that well-functioning banking systems accelerate long-run economic growth but poorly functioning banking systems can impede economic progress, exacerbate poverty and destabilize economies (Bath, Capro and Levine, 2001). Therefore, efficient bank operation and stability should be a major macro-economic concern of a nation. To ensure that the banking system is efficient and operationally effective, the government of every country does exert some regulatory controls. One such control is the regulation of bank capital base through capital requirement policy. Studies have shown that a strong financial base is sine quo non for effective operation and efficient delivery of financial service by banks. The solid financial base will assist the banks to withstand fluctuations in the liabilities portfolio and be able to absorb some unexpected losses due to asymmetric information on their customers. The ability of banks to provide needed credit in a fast developing economy and to robustly compete in an ever increasingly competitive environment is enhanced with strong capital base, ceteris paribus.

Over the years the issue of capital requirement policy has always been left in the hand of the monetary authority in each country. Recently due to increase in bank failure and the attendant effect on the real sector of the economy, the campaign of bank capital adequacy has taken international dimension. Countries have begun to team up to regulate this most sensitive segment of their economy. The current globalization has also made the need for bank regulation inevitable if countries are to benefit from cross countries investment opportunities. It is with this belief that the Basle Accord was initiated and an agreement was reached among stakeholders on what should be the minimum capital base of banks in the participating countries. Apart from the global effort, in recent years, the Central Bank of Nigeria (CBN) has consistently enforced flat capital requirements in terms of minimum paid-up capital in the Nigerian banking sector. The most significant leap in this direction was the 2004 financial reforms in which the number of banks was pruned down to *25* due to a CBN directive on minimum capital base of N25 billion.

Nevertheless, while some financial theorists continued to emphasize the importance of capital base in banking effective operation, empirical studies in some countries had revealed that higher bank capital levels do not, by themselves, guarantee that banks are adequately capitalized. This is so whenever banks have high ratios of risk-weighted assets to unweighted assets (See, for example, Shrives and Dahl, 1992). .For instance, despite the fact that the CBN has been enforcing capital adequacy requirements, the Nigerian banking system has always been under distress. For instance, six technically insolvent banks were taken over by the CBN in 1993. In 1995, seventeen other technically insolvent banks were taken over by the apex bank. Between 1994 and 1998, the operating licenses of thirty one banks were revoked by the CBN (Ogunbunmi, 2004). Surprisingly, the reform acclaimed panacea to the banking distress in Nigeria has begun to show sign of defect as three of the 25 banks

were technically grounded just two years after the N25 billion naira minimum recapitalization reforms of 2005. Hence this research work attempts to analyze the main determinants and the relative contributions of changes in capital base to the efficiency of Nigerian Commercial Banks.

Statement of the Research Problem

Basle Accord is a framework for measuring capital adequacy and minimum standard by internationally active banks (Bank for International Settlements, 1988). The basis of the 1988 Accord was that a consistent standard be applied for determining minimum capital requirements across internationally active banks. These capital requirements were structured to make regulatory capital sensitive to differences in risk portfolios across banks, with banks holding riskier assets required to hold a higher level of capital (Ford and Weston, 2003). The role of bank capital is to act therefore as a buffer against future, unidentified, even relatively improbable losses, whilst still leaving the bank able to operate at the same level of capacity.

The recent problems of some of the newly recapitalized banks in Nigeria might have been averted if the reform was based on proper appraisal of the past efforts and the underlining factors generating crisis in the banking system. While several attempts were made in the past to assess the overall effects of financial reforms on banking operation in Nigeria, less attention was paid to the issue of capital base especially the operational effectiveness of increasing capital base in the banking industry. The neglect of this important aspect of the banking regulation might undermine the policy relevance of the existing evidence on the operational efficiency of Nigerian banking industry. Appraising the contribution of bank capital on the banking operation in Nigeria is inevitable and urgent to lay solid foundation for further reforms in the banking industry in Nigeria. So, this research attempts to fill this empirical gap in the existing literature on the main determinants and the relative contributions of changes in capital base to the efficiency of Nigerian Commercial Banks capital base and banking operation in Nigeria.

Research Questions

In order to situate the research in the right perspective, the following pertinent issues are raised for investigation:

(i) To what extent has bank recapitalization over the years contributed to the performance of Nigeria banks?
(ii) What are the main factors determining changes in the bank efficiency in Nigeria?

Objectives of the Study

The broad objective of the research is to examine the relevance of bank recapitalization to improving the operational efficiency of banks in Nigeria. This is further broken down into the following specific objectives:

(a) Analyze the main determinants and the relative contributions of changes in capital base to the efficiency of Nigerian Commercial Banks.

Research Hypotheses

To achieve the above specific objectives this proposition will be tested empirically:

H_0: There is no relationship between capital base and operational efficiency of Nigerian Commercial Banks.

Justification of the Study

Recently, regulators have increased their focus on the capital adequacy of banking institutions in order to enhance the stability of the financial system (Bertrand, 2000). The increasing reliance of regulators on capital requirements raises some fundamental questions that have dominated the discussions on the bank capital adequacy: one, do banks respond to capital requirement, that is, are the penalties for falling below the regulatory guidelines large enough to induce banks to raise their capital ratio? Two, how do banks improve their capital ratio when they approach the regulatory minimum, that is, do they increase their capital or reduce their higher risk assets? Three, does increase in capital requirement induce banks to reduce or increase the riskiness of their portfolio?

Analysis of how banks in developing countries like Nigeria have responded to the 1988 bank capital adequacy is of course crucial if one wants to gain insight into the likely implications of the Basle Accord. Our perusal of these studies shows that no serious attempt was made to examine the main determinants and the relative contributions of changes in capital base to the efficiency of banking recapitalization in developing countries like Nigeria. The neglect of this on of the world economy is surprising in view of the fact that the consequence bank failure in any part of the world whether developed or developing, has pervasive effect on the general world financial system.

Scope of the Study

This study covers a period of sixteen years from 1992 to 2007. The period was chosen as it coincided with the period Nigeria became a signatory to the Basle Accord and the period a new bank capital regulatory mechanism was introduced. In 2004 a new bank order in which recapitalization, merger, and acquisition of controlling interest as the central mechanism to achieve what the Basle Accord was also set to achieve. By implication, the study will serve as an appraisal of existing regulatory order as basis for the implementation of the new order in Nigeria. Extending the analysis to 2007 therefore serves as an appraisal of the ongoing reforms

and the recapitalization policy of 2004. A cross-sectional time data were collected on the commercial banks that were in existence during this period Existence of bank's branches in the rural areas of the country and availability of data on the bank were the criteria for bank selection.

This research is made up of five sections, each dealing with the different aspect of the study. It commenced by providing a background of the subject matter justifying the need for the research work. Section two reviewed related literature concerning the significance of the main determinants and the relative contributions of changes in capital base to the efficiency of Nigerian Commercial Banks. The third section presents theoretical framework and research methodology for the study. Section four utilized modern econometric techniques to analyze data and discussed findings. The last section of this research concludes and recommends vital measures for promoting the main determinants and the relative contributions of changes in capital base to the efficiency of Nigerian Commercial Banks.

2. EMPIRICAL LITERATURE

In this section, we review the empirical bank literature which may give implications for the optimal capital structure, risk-taking, and interaction with regulation and supervision. We start with a presentation of the most extensive strand which studies the relationship between capital and risk under different regulatory regimes (flat and risk-based capital regulation). Then, we continue with more specific studies on questions concerning the impact of deposit insurance, charter value, and ownership structure on bank risk-taking. We round up with a review of capital market reactions to recapitalization.

Studies on Relationship Between Capital, Risk, and Regulation

Before the early 1980s, US regulation could be characterized by a peer group approach which means that supervisors oriented themselves at the average bank balance sheet. *Marcus (1983),* who tries to explain the decline in capital to asset ratios in U.S. commercial banks between 1965 and 1977, confirms the peer group theory of regulatory pressure. This implies that when all banks suffer capital losses (for example, from a rise in the interest rate), the increase in regulatory costs for a particular bank is much smaller than it would be if that bank alone lowered its capital. "Drops in capital common to all banks do not induce regulatory review of any particular bank and consequently do not require banks to readjust capital" (Stolz, 2002). In the early 1980s, minimum capital-asset ratio requirements supplanted the earlier peer group type of capital regulation (Stolz, 2002). Using the same methodology, *Keeley (1990)* studies the effect on the capital positions of the 100 largest bank holding companies. He finds that the regulations succeeded in causing banks with low capital ratios to increase their book value of capital ratios both absolutely and relatively to banks with initially high capital ratios, and that banks did so primarily by slowing asset growth.

Studies on Risk Sensitive Capital Requirements

By applying the Shrieves and Dahl methodology, *Rime (2001)* analyses adjustments in capital and risk of Swiss banks when they approach the minimum regulatory capital level. Switzerland is interesting insofar as Swiss capital requirements might be more risk-sensitive as the Basel Accord as they stipulate a larger number of risk classes. Furthermore, regulatory pressure might be stronger in Switzerland than in the US as a breach of the guidelines rapidly leads to the closure or to the take-over of the bank. Rime found the same empirical evidence for Switzerland as Ediz, Michael, and Perrauding for the U.K. This is that regulatory pressure induced Swiss banks to increase their capital, but did not affect the level of risk. A plausible explanation for the relative rigidity of Swiss banks' portfolios is the lower liquidity of assets due to a less developed market for small banks stocks and the absence of a market for asset-backed securities.

Studies within the Options Pricing Framework

This strand of the literature is reviewed in an own subsection because it applies a very different methodology to the studies just surveyed. Furlong (1988) studies how the default risk of large U.S. bank holding companies changed in the pre-Basel period from 1975 to 1986. His approach builds on the insights of the option pricing theory that the equity market capitalization of a bank may be regarded as the value of a call option written on the bank's underlying asset value with deposits being interpreted as the option's strike price. Furlong then infers the volatility of the asset values by inverting the Black and Scholes call option pricing formula. He finds that asset risk measured in this way actually doubled in 1981-1986, the part of his sample in which banks faced capital requirements, compared to the earlier period. It appears that the large increase in asset risk more than offset the improved capital positions thereby increasing default risk.

3. RESEARCH METHODOLOGY

Data Sources and Sampling Procedure

This study is a panel data study. It collected data on some individual banks for specific periods of time 1992 to 2007 and coalesce these data together to generate a pooled data series. Hence the study is both time series and cross sectional. Therefore, secondary data time series were collected on some selected banks for the

period 1992 to 2007. The population included all the banks in existence from 1992 to 2007. Therefore from about eighty seven banks, thirty two were selected. The criterion used for the selection was availability of consistent data on the bank for the whole sample period(See appendix B for the list of banks in the sample). Data on all these banks were collected from their annual reports submitted to the Central bank of Nigeria and Nigeria Stock Exchange. Where such data were not available, the banks involved were visited to gather the data from their archives.

Model Specification

The focus of this study was twofold. It examined the factors determining the capital size of the bank and how the changes in the bank capital due to these factors have impacted on the bank operational performance in Nigeria. To carry out these analyses therefore two distinct models were specified. First, one model examined the determinants of changes in capital base of bank and the other examined the relative contribution of capital base on bank operational performance in Nigeria.

The first model flowed from the theoretical framework that the level of capital raised depends on the following variables: P_0, t, C_{DB}, r_y R_{DB}, a**,** p and the standard deviation of the earnings Y. The demand for capital can be written as follows:

$$W^d = (P_o — (t + C_{DB} + r_y R_{D,B}),a, \delta(Y),p) \quad (3.1)$$

Where

W_d = Demand for equity capital

C_{db} = operating Cost

T_d= returns on deposits

Ry= opportunity cost of holding reserves

P(o) = required rate of returns

P = cost of adjustment

A= asset return

Y = gross earnings

The theoretical framework is also presumed that capital and risk decisions are determined simultaneously. To recognize this, we based our analysis of Nigerian banks' capital behaviour on the model developed by Shrives and Dahl (1992). In the model, observed changes in banks' capital consist of two components, a discretionary adjustment and a change caused by factors exogenous to the bank:

$$\Delta CAP_{j.t} = \Delta^d CAP_{j.t} + E_j \quad (3.2)$$

Where $\Delta CAP_{j.t}$ is the observed change in capital for bank j in period t.

The discretionary changes in capital $\Delta^d CAP_{j.t}$ *is* modeled using the partial adjustment framework, hereby recognizing that banks may not be able to adjust to their desired capital ratio level instantaneously. In this framework, the discretionary change in capital is proportional to the difference between the target level and the level existing in period t - 1:

$$\Delta^d CAP_{j,t} = \alpha(CAP^*_{j,t} - CAP_{j.t-1}); \quad (3.3)$$

Where $CAP^*_{j,t}$ *is bank) j's target capital.*

Substituting equations (3.3) into equations (3.2), the observed change in capital can be written:

$$\Delta CA_{j,t} = \alpha\,(CAP^*_{j,t} - CAP1_{j,t-1}) + E_{j,t} \quad (3.4)$$

This means that the observed change in capital in period t is a function of the target capital, the lagged capital ratio, and any random shocks.

Modeling Determinants of Banking Efficiency:

The outcome of bank activities can be deemed to mean their outputs. The aim of any bank is to be efficient in the optimal combination of its inputs using the existing technology to produce a desired level of service output. This efficiency of the bank can therefore be determined by the changes in the volume of service output rendered by the bank relative to the inputs. Therefore the bank financial production function can be written in the form of Cobb Douglas function as:

$$Y = A\,L^{\alpha} K^{\beta} \quad (3.5)$$

Y represents service (output) produced by the banks by combining financial resources capital ***K*** and Human resources ***L*** and **α , β** are the parameters representing the output service elasticity of each input. A represents other factors that can affect output apart from physical and human capital. Such inputs captured by A are level of technology and other institutional factors. K in equation *3.5* can be replaced with CAP from equation 3.4 So that equation *3.5* becomes:

$$\Delta Y = \Delta(A\,L^{\alpha})\,\Delta(CAP)^{\beta} \quad (3.6)$$

Substituting for CAP in equation 3.6 with equation 3.4 then equation 3.6 becomes

$$\Delta Y = \Delta(AL^{\alpha})\,\mu\,(CAP^*_{j.t} - CAP_{j.t.-1}) + E_{j.t})^{\beta} \quad (3.7)$$

Expressing Equation 3.7 in Log linear form we have

$$\Delta \mathrm{In}Y = \mathrm{In}A + \alpha\Delta \mathrm{In}1 + \mathrm{In}\mu + \beta \mathrm{In}\,(cap^*_{j.t} - \delta Incap_{j.t-1}) + E_{j.t} \quad (3.8)$$

The target capital ratio *(cap*)* is not observable; it is assumed to depend on a set of observable variables describing the bank's financial conditions and the state of the economy. The variables that we used to approximate the target capital cap* were the size of the bank (SIZE), the loan ratio (LOANS), current profit (PBT), changes in the risk ratio (RISK), and the degree of regulatory pressure (REG). Apart from these bank variables, CAP* is approximated and redefined as by

CAP* = *f(LLOSS, ΔRISK, CAP, SIZE,* REG) ……*(3.9)*

Other variables considered important as major determinants of changes in bank operating performance are the bank input variables. The most commonly used are the labour inputs, capital input and deposit. Input variables: labour and physical capital will be proxies by the price of labour (PL) and price of capital (PC). In addition the price of deposits (PD) that also serves as capital to the bank but also liabilities is also included. Based on the objective of the study, two variables represent the dependent variables(Y); these are Profit generating capacity (PGC) and bank operating efficiency measured as returns on Asset (ROA).

On the basis of the analysis in sub-section 3.2, and in line with the objectives of the study, the model defined by equations (3.4) and (3.6) are remodified as follows:

$$\Delta CAP_{j,t} = \alpha_0+\alpha_1 RISK_{j,t}+ \alpha_2 LLOSS_{j,t} + \alpha_3 NM1_{j,t1}+ \alpha_4 ML_{j,t}+ \alpha_5 01_{j,t}+ \alpha_6 FBT_{j,t-1}+ \alpha_7 ROA+ \alpha_8 SIZE_{j,t} + \alpha_9 REG_{j,t} + \varepsilon_{j,t} \quad (3.10)$$

$$\Delta PGTC_{j,t} = \alpha_0 + \alpha_1 PL_{j,t-1} + \alpha_2 PD_{j,t-1} + \alpha_3 PC_{j,t-1} + \alpha_4 CAP_{j,t} + \varepsilon_{j,t} \quad (3.11)$$

$$\Delta ROA_{j,t} = \alpha_0+ \alpha_1 PL_{j,t} + \alpha_2 PD_{j,t-1} + \alpha_3 PC_{j,t} + \alpha_4 CAP_{j,t} + \varepsilon_{j,t} \quad (3.12)$$

The concept of causality we adopted is Granger causality.

4. DATA PRESENTATION, ANALYSIS AND DISCUSSION

This section presents the empirical analysis carried out on the relationship between capital base requirement and measures of bank performance. Thus, the section is sectionalized on the basis of these objectives. The descriptive properties of the variables were also examined by conducting an analysis of the mean, medium and standard deviation of the variables. Furthermore, correlation coefficients and causality nexus among the variables were examined. Section 4.3 presents the analysis of determinants of capital base while Section 4.4 presents and analyzes the empirical results for the relative effects of capital requirement on both profit generating capacity and operating efficiency of banks in Nigeria.

In order to explore further the linkage and to avoid spurious interpretation of the result from the causality nexus among the variables examined to determine the causal relationship between bank efficiency indices and capital base requirement as well as other bank related variables, the correlation coefficients between pairs of these variables are examined before granger causality is used to determine the direction of influence. To this effect, the correlation and causality among the key variables are presented in table 4.3. As shown in table 4.3 the relationship between changes in return on assets (ROA) and changes in capital base of the banks is positive but very low. Similar pattern is observed in the cases of bank risk level, profit before tax, input variables (prices of physical capital (PC), deposits (PD) and labour (PL)) and profit generating capacity (PGC).

Table 4.3: Correlation Matrix

Correlation Coefficient of the Key Determinants of Bank Performance

	ROA	CAP	PD	PC	PL	RISK	LLOSS	PBT	PGC
ROA	1.000								
CAP	0.043	1.000							
PD	*0.247*	*0.009*	*1.000*						
PC	0.030	0.115	-0.075	1.000					
PL	-0. 091	0.128	0.144	0.090	1.000				
RISK	0.033	0.161	0.060	0.019	0.084	1.000			
LLOSS	-0.037	-0.100	0.099	0.012	0.195	0.133	1.000		
PBT	0.204	0.622	0.226	0.018	0.070	0.088	-0.085	1.000	
PGC	0.078	0.223	0.074	0.051	0.042	0.010	-0.200	0.181	1.000

Source: **Panel Study 2007**

Generally, Return on assets has low correlation with most of the variables. Except with price of deposit and profit before tax which have about 20% correlation coefficient, the correlation coefficients of all other variables are less than 10%. The table further reveals that return on assets is only negatively correlated with price of bank labour and changes in loan loss (LLOSS). The correlation between the capital base requirement and profit generating capacity as well as profit before tax are also worth mentioning. Both Profit generating capacity

and profit before tax have positive but low correlation with most all the variables except loan loss ratio. The size of the correlation is low but the fact that they are positive shows that the variables move in tandem.

One major shortcoming of correlation coefficient analysis is that the direction of the influence could not be detected and also the high or low correlation between two variables does not imply the existence or non-existence of causal nexus between the variables. The granger causality approach is adopted to examine the causal nexus between the bank efficiency factors and profit generating capacity. The granger bivariate causality is done to determine the one-to-one causal effects among the variables. Table 4.4 below presents the estimates of the bivariate causality test.

Table 4.4: Results of the Estimates of Causality Test

Null Hypothesis:	F-Statistic	Probability
LPD does not Granger Cause LROA	5.51047	0.00453
LROA does not Granger Cause LPD	11.0853	2.40E-05
LROA does not Granger Cause LPL	5.48407	0.00464
LCB does not Granger Cause LPC	3.03478	0.04983
LCB does not Granger Cause LPL	2.88347	0.05775
LCB does not Granger Cause LPBT	8.1624	0.00037
LPGC does not Granger Cause LCB	21.803	1.80E-09
LPL does not Granger Cause LPD	5.67361	0.00387
LLLOSS does not Granger Cause LPD	3.45609	0.03302
LPBT does not Granger Cause LPD	6.93642	0.00116
LPGC does not Granger Cause LPC	56.5078	0.00007
LRISK does not Granger Cause LPL	4.34042	0.01398
LLLOSS does not Granger Cause LPL	6.98861	0.00111
LRISK does not Granger Cause LLLOSS	7.3062	0.00082
LPGC does not Granger Cause LPBT	24.2007	2.30E-10

Note: the F-statistics is significant if probability value is less than 0.5 ($p \leq 0.5$) at 5% critical level.

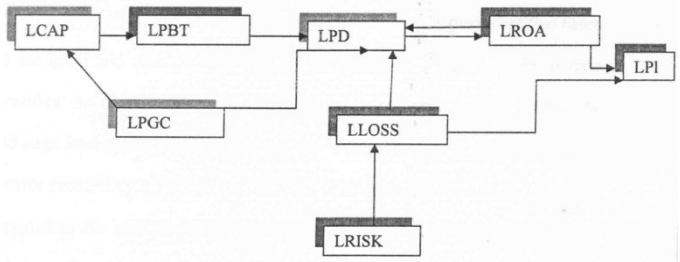
Source: Panel Study 2007

As shown by causality test reported in table 4.4 above, profit generating capacity has one way directional causal effect on both capital base and price of deposit. Capital base has one way causal effect on profit before tax, and profit before tax unidirectional causal effect on price of deposit. The causal relationship between prices of deposit and return on assets is in both ways; that is, price of deposit affects return on assets and at same time return on assets also affects price of deposit. Price of deposit is also affected by provision for loan loss while provision for loan loss is affected by risk- taking behavior. Loan loss rate and return on assets also cause changes in the price of labour of the banks.

Therefore, capital base requirement has only indirect significant causal effect on bank efficiency, since bank capital base causes profit generating capacity which in turn causes price of deposit that has direct causal effect on return on assets, then it can be said that capital base requirement may influence changes in the bank performance through its channel. Similarly, risk behavior of banks many not have direct effects on returns on assets but it has indirect effect through the deposit price channel.

Similarly, risk behavior of banks many not have direct effects on returns on asset but it has indirect effect through the deposit price channel. The direction of causation is illustrated in the diagram below.

Figure 4.3: Illustration of the Causal linkage among the Bank Performance Determinants



Model Estimations, Analyses of Estimation Results and Inferences

Financial Determinants of Bank Capital Base Requirement

Given the simultaneity of relationship in the model, the conventional Ordinary Least Square (OLS) technique will be inappropriate in estimating it. The OLS assumes, among other things, that the explanatory variables are either not stochastic or if stochastic are distributed independently of the stochastic disturbance term. In a model of simultaneous relationship, such as our model, the above condition is violated. The use of OLS in the estimation of such a model would produce not only biased estimates but also inconsistent estimates. That is, as the sample size increase indefinitely, the estimates would not converge to their true (population) values (Gujarati, 2005). Since the OLS is inappropriate there is the need to use alternative estimation technique that will make the model estimates unbiased, consistent and efficient.

A thorough examination of the model reveals that it is over identified based on the order and rank of conditions for identification. When a model is over identified, the most appropriate single equation estimation technique for it is the two-stage least square technique (TSLS). The TSLS is well known for its ability to provide satisfactory results for the estimates of structural parameters and has been accepted as the most important single-equation technique for the estimation of over identified models (Madallas, 2001). Therefore the behavioral relationship of the model will be estimated by TSLS technique, using annual data that run from 1992 to 2007.

It has also become fashionable in contemporary econometric analysis to consider issues of stationary, co integration and error correction mechanism (ECM) when dealing with models involving time series variables. Stationary assures non-spurious results; co integration captures equilibrium long run or relationship between (co integrating) variables, and error correction mechanism is a means of reconciling the short run behavior of an economic variable with its long run behavior (Gujarati 1995). However, the foregoing issues are not necessary for this particular model because it is considering short run effects and it is a multi-equation system. Furthermore it is using a powerful functional form-logarithmic indexation, where the index forms of virtually all the variables are taken and the logarithmic of all the variables are used. This ensures the robustness of estimates.

As can be seen from Table *4.5* the explanatory powers as judged by the adjusted R^2, is relatively high given the fact that the variables are in log-linear form. The significance of the proportion explained by the variables in the model which is captured by the R2' the coefficient of determination is not in doubt as the F-statistics sufficiently confirms the significance of the R2. Hence the model adequately captured the empirical relationship between economic growth and the variables included as its determinants in the model. In term of relative contributions of each variable in the model, results in table *4.5* shows that the signs on the coefficients of the variables are mixed. Some have positive while a reasonable number also has negative sign. For instance lag capital (CAP (-1)), bank size (LSIZE) and loan loss provision (LLOSS) are negative. The significant negative effect of the previous level of bank capital indicates that the banks were only slowly adjusting their capital to desired levels in period under study. Indeed, banks, most often, wait for the CBN directive before initiating any significant change in their banks capital size. The fear of unknown in the Nigerian banking industry makes some banks reluctant to increase their capital base.

The coefficient on risk ratio is significant and positive. Suggesting that the higher the increase in the risk levels the more the banks are compelled to increase capital base. Bank size has significant negative impact on bank capital ratios. Possible interpretations are that large banks have access to capital market, and can therefore operate with lower amount of capital or that they feel less pressure to increase capital because of a *too-big-to-fail-effect;* a larger size also allows greater diversifications to mitigate the credit risk exposure. As hypothesized, net loans as percentage of total assets are good proxy of target risk profile of banks as they always increase significantly the credit risk by less than what is necessary to compensate the increase in risk. The coefficient on risk exposure is positive and significant. This positive relationship between risk exposure and bank capital does not support Koehn and Santomero's conclusion that banks will try to offset the loss in utility from the upper limit on leverage by choosing a riskier portfolio. Indeed, higher risk ratios do lead to an increase in capital. The return on asset was found to have a positive effect on bank capital ratios, a result consistent with the hypothesis that banks with higher earnings could retain more capital.

Finally, loan loss provision as percentage of total asset (LLOSS) had no significant effect on bank capital. More important, examining the coefficient on the regulatory pressure by CBN (REG) which is positive and significant; banks in Nigeria generally are not proactive in the capital mobilization. They tend to wait till they are externally forced/compelled to shift their capital base. Most often the CBN strikes the big stick whenever there are serious signs of distress and the banks capital base is seriously undermined. The implication of this is that, central bank in Nigeria plays a significant role in bank capital determination. Thus, suggesting that bank capital of Nigerian banks at least during the study period depended less on market forces but more on institutional pressure.

Profit generating capacity and profit before tax are other variables with significant positive effects on bank capital. This strong relationship is expected since the higher the profit made by banks the higher the ratings of the banks and the confidence of investors and core shareholders. As the capacity of the banks increases and the banks make more profit, the existing capital may become inadequate to withstand the financial pressure generated from the increase profit and earnings capacity. Thus the bank capital will be reviewed upward even when there is less regulatory pressure from the CBN. A careful analysis of the size of coefficient shows that regulatory pressure is the most important factor that determines the size of bank capital. Apart from the regulatory pressure, the next most important factor is return on Asset and followed by profit before tax level and risk exposure. Profit generating capacity and loss provision trailed behind.

Table 4.5: Results of Estimates of Bank Capital Base Determinants

Dependent Variable: LCB				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCAP(-1)	-0.123689	0.077443	*-2.597149*	0.0115 x
LRJSK	0.401229	0.174836	2.294884	0.0225 xx
LLLOSS	*-0.051563*	0.065867	-0.782833	0.4344
LSIZE	-0.225675	0.068994	-3.270937	0.0012 x
LPBT	0.467117	*0.074425*	6.276376	0.0000 x
LPGC	0.127144	0.050123	2.536640	0.0118 x
REG	1.950007	*0.633509*	3.972246	0.0001 **x**
LROA	1.932696	1.005080	1.922928	0.0556 xx
R-squared	0.758943	Mean dependent var		14.01706
Adjusted R-squared	0.746668	S.D. dependent var		2.089722
S.E. of regression	1.530401	Akaike info criterion		3.718771
Sum squared resid	599.5848	Schwarz criterion		3.827 133
Log likelihood	-482.8778	F-statistic		33.48116
Durbin-Watson stat	1.958506	Prob(F-statistic)		0.000000

Source: Panel Study 2007

Guide to analyses of estimates:X Beta coefficient is significant at 1% level of significance; and XX Beta coefficient is significant at 5% level of significance.

Table 4.6: Results of Breusch-Godfrey Serial Correlation LM Test:

F-statistic		18.78936	Probability	0.000000
Obs*R-squared		34.02436	Probability	0.000000
Test Equation:				
Dependent Variable: RESID				
Date: 05/24/08 Time: 11:00				
Presample and interior missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LLLOSS	0.027915	0.061986	0.450334	0.6529
LSIZE	-0.036774	0.064985	-0.565882	0.5720
LROA	0.009258	0.072749	0.127264	0.8988
LPBT	0.001669	0.069740	0.023931	0.9809
LPGC	-0.011723	0.047016	-0.249332	0.8033
LRISK	-0.415313	0.183169	-2.267378	0.0242
REG	-1.37E-09	1.55E-09	-0.883010	0.3781
C	0.676917	0.948604	0.713592	0.4761
RESID(-1)	0.303797	0.069755	4.355217	0.0000
RESID(-2)	0.186143	0.061244	3.039341	0.0026
R-squared	0.128880	Mean dependent var		9.58E-15
Adjusted R-squared	0.098014	S.D. dependent var		1.509897
S.E. of regression	1.433994	Akaike info criterion		3.595947
Sum squared resid	522.3102	Schwarz criterion		3.731400
Log likelihood	-464.6650	F-statistic		4.175412
Durbin-Watson stat	1.951723	Prob(F-statistic)		0.000048

Source: Panel Study 2007

Contribution of Bank Capital to Bank Operational Efficiency

The effects of bank capital on bank efficiency measures in terms of returns on asset are examined in this section. The estimated values of bank capital are used as the proxy for the effects of other variables in the bank capital model on bank efficiency. In this way, the effects of all the bank variables in the capital model are incorporated in addition to the separate effect of capital base itself. Hence, the other bank variables are excluded from the model since their effects are already captured by the predicted bank capital series derived from model used in model for bank capital above. Table 4.7 presents the estimates of the model with predicted values for bank capital (CAPF) as measures of bank capital. The other variables in the model are price of labour (LPL), price of capital (LPC), price of deposit (LPD), non mortgage loans (LNM), mortgage loans *(LML),* and other loans and investment (LOT).

The explanatory power as judged by the adjusted R2, (70%) is relatively high. The significance of this the R2' is not in doubt as the F-statistics sufficiently confirms the significance of the R2. Hence the model adequately captured the empirical relationship between bank capital and bank efficiency and the variables in the model.

Table 4.7: Results of Estimates of Bank Efficiency Model

Dependent Variable: LROA

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPD	0.468907	0.103320	*4.538394*	0.0000 x
LPL	-0.284671	0.144645	-1.968069	0.0501 xx
LPC	0.037 194	0.086949	0.427769	0.6692
LML	*-0.050467*	*0.045254*	-1.115185	0.2658
LNM	-0.036907	0.055969	-0.659415	0.5102
LOI	**0.094676**	**0.036840**	**2.569899**	**0.0107 x**
CAPF	0.136033	0.063307	2.148773	0.0326 xx
C	-3.872573	0.917793	-4.219440	0.0000
R-squared	0.724433	Mean dependent var		-2.379786
Adjusted R-squared	0.700492	S.D. dependent var		1.257834
S.E. of regression	1.192960	Akaike info criterion		3.220586
Sum squared resid	364.3272	Schwarz criterion		3.328949
Log likelihood	-417.1174	F-statistic		5.197445
Durbin-Watson stat	2.065733	Prob(F-statistic)		0.000015

Source: Panel Study 2007

Guide to analyses of estimates: X Beta coefficient is **significant at 1% level of significance; and XX Beta coefficient is significant at 5% level of significance.**

Inference

According to table 4.7, the beta coefficient of capital base (CAPF) is significant and positive at 5% level of significance. The null hypothesis - there is no relationship between capital and operational efficiency of Nigerian Commercial Banks is rejected.

Before analyzing the effect of capital base of banks on their performance, it is important to examine the relative contributions of other determinants of bank performance first starting from the input variables: the price of deposits *(t = 4.53)* and price of labour (t = - 1.97) are both significant, while the effect of price of capital employed is insignificant (t = 0.4). However, the effect of cost of labour in the banking industry has negative effect on the efficiency of the banks. The coefficient is negative and indeed a 10 percent increase in the cost of labour is likely to result in reduction of the efficiency and or in return on asset of the banks by as much as 3 percent. This implies that workers' emoluments are one of the main factors determining the profitability and performance of Nigerian banks. This is not surprising as there is salary war among the Nigerian banks. The rate of staff turnover is high and most banks tend to lure their strategic workers with salary incentives.

Interestingly, the effect of cost of deposit is positive and by implication an increase in the interest rate on deposits results in increase in bank efficiency and performance. This may look unintuitive as one would have expected the increase in cost of deposit to have negative effect on the profitability and return on assets. However, a deep thought will show that increase in cost of deposit need not result in reduction in efficiency of banks. As the interest on deposit increases, the public will be encouraged to convert their money balance from checkable account to long term savings. This increase in savings due to increase in deposit rate, provides banks with funds to engage in long term investment, and be able to earn higher returns that can adequately pay for the increase in the cost of deposit. The determining factor therefore is not the absolute increase in the cost of deposit but the

differences between the cost of deposit and lending. If the differential is wide and high then bank will make more profit. Hence, increase in the cost of deposit may promote bank efficiency and higher profitability.

The cost of physical capital is not significant though positive. This means that bank's returns on assets respond sluggishly to stimulus from changes in the cost of capital procurement. One possible reason for this is that most banking operations are becoming less of physical capital intensive. The technological revolution has brought a lot of changes into the banking industry. Gone are the days where cubicles and walls are the orders of the days. The most important physical capital now is computer and the use of the internet has even reduced the need for several computer points. The use of ATMs has also allowed the sharing of cost on capital among banks. These have resulted in reduction in overhead cost and increase in return and bank operational efficiency and performance. It has also resulted in higher profit and better customer relations and bank access by the public.

The effect of investment in mortgage (loans) is negative (-0.05, t-l. 12) and insignificant. Similar pattern is observed in the case of none mortgage loans. The effect of non-mortgage loans was also insignificant and negative. This implies that banks financial intermediation in general and specifically into properties development is not a significant determinant of bank performance. This may not be surprising. Most of Nigerian banks are leaving their core financial intermediation activities to none conventional banking activities. In present day Nigeria, banks engage more in sales of forms for institutions, collection of dues for government agents and indeed earn much of their income from forex trading and financing. On the other hand, the effects of other investments such as engaging in stock trading, credit financing and other commercial papers has significant positive effects on bank performance.

To the main focus of the study, the relative effect of bank capital base on bank performance. As can be seen from the estimates in Table 4.7, the coefficients of bank capital base is 0.13 with t-value of 2.14 and a p-value of less than *0.05,* thus implying that the effect of changes in bank capital base is positive and significant at least at *5%* critical value. The consequence of this is that, the size and changes in the capital base of bank determine to a large extent the degree of healthiness and profitability of banks. This explains why the Central bank of Nigeria emphasizes the centrality of strong capital base as sine quo non to sound and efficient banking system. The capital base of the bank is very important; it is the main linkage between the shareholders and the banks. The more the capital invested and committed by the .bank shareholders, the more their interest in the survival of the bank. Banking sector is a special case of general profit and rent seeking business. The specialty arises from the fact that they utilize other people's money to trade. If there are no checks and balances on the bank management, it may not bother about what happens to their liabilities since their own liabilities are limited by law. So the only way to entrench commitment and dedication to public interest is to make it mandatory for banks to have sufficient proportion of the funds they trade with as their contribution through capital base. The recent experience in Nigeria, when the capital base minimum bench mark was raised from mere N2billion to N25billon, has really turned around the banking operations in Nigeria.

General Discussion

The main findings from the empirical analysis are:

(i) There was a significant causal nexus between bank capital base and the two measures of bank performance. However, capital base requirement has only indirect significant causal effect on bank efficiency because bank capital base did not cause return on asset directly. Bank capital base causes profit generating capacity which in turn causes price of deposit that has direct causal effect on return on asset. Then it can be said that capital base requirement may influence changes in the bank performance through cost of deposit mobilization and credit channel. Similarly, risk exposure behavior has indirect effect through the deposit cost channel.

(ii) The previous level of bank capital has negative effects on current bank efficiency. The significant negative effect of the previous level of bank capital indicates that the banks were only slowly adjusting their capital to desired levels.

(iii) The major determinants of changes in bank capital are bank size, risk exposure, loan loss provision, the regulatory pressure, Profit generating capacity and profit before tax. However, while risk exposure, profit generating capacity and regulatory pressure have positive effects, bank size has negative effects on bank capital base.

(v) Bank capital was found to be a significant determinant of both bank operating efficiency and profit generating capacity. Indeed, bank capital was the most significant contributor to growth and increase in the capacity of banks to generate greater profit and to enhance its operating efficiency.

5. CONCLUSION AND RECOMMENDATIONS

Conclusion

The research has shown that the regulatory pressure is an integral factor in bank efficiency determinant.

It was crucial to ensuring bank efficiency and ability to generate greater profit and yield higher returns for the shareholders. More import, bank capital was a major determinant of bank performance and efficiency. This suggests that the central bank of Nigeria can use the regulatory power of raising the capital base of banks to stimulate greater efficiency and ensure that banks still generate sufficient profit for the shareholders. The recent development in the mega banks in the US and other advanced European countries is signal that bank has optimal threshold level at which additional increase in capital base may be inimical to the healthiness of the banking industry and the overall economy.

Recommendations

Since capital base has significant positive effect on bank operational efficiency and capacity to generate profit, it can be instrumental in promoting bank soundness and stability. The followings are therefore recommended:

i. Bank capital regulation must be anchored on a sound monitoring system which regularly assesses the economy, ascertains, and establishes the level of capital commitment required by the banking sector;

ii. Adjustment must be made to the established level of capital commitment in (i) above so that the weakness in bank asset portfolio and liability portfolio are adequately taken into cognizance;

iii. A prudently established new capital requirement must be promptly and rigorously enforced;

iv. The system of internal control must ensure checks and balances at all time and there must be transparency and accountability in each bank so that the efforts of recapitalization will not be in vain.

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